

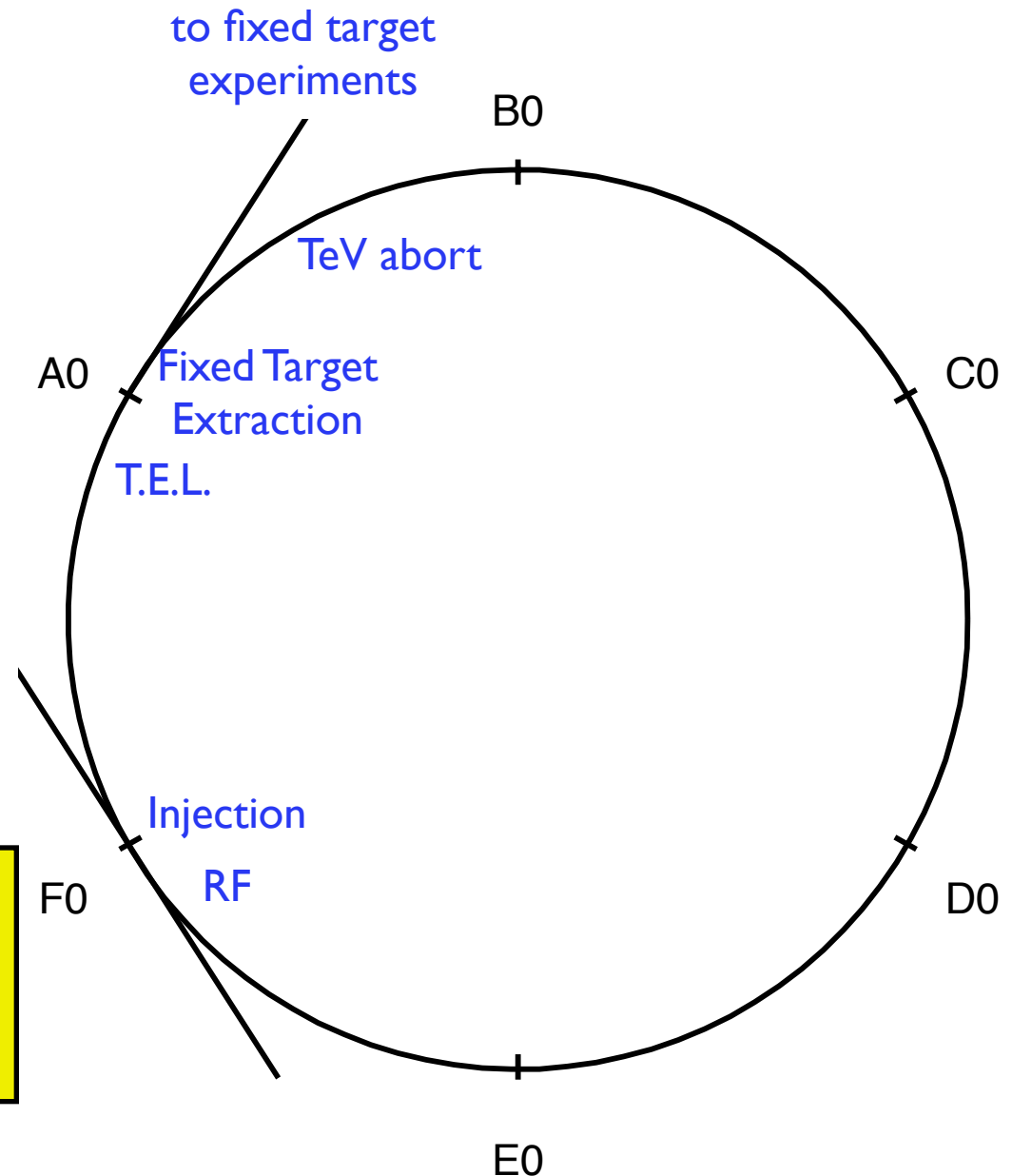
Beam Monitoring at CDF

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Accelerator Map

- 6 sectors (A-F)
- 5 houses/sector (0-4)
 - Accelerator access
 - Tevatron infrastructure (power, water, cryogenics, etc.)
- Naming convention for devices (magnets/collimators, etc.)

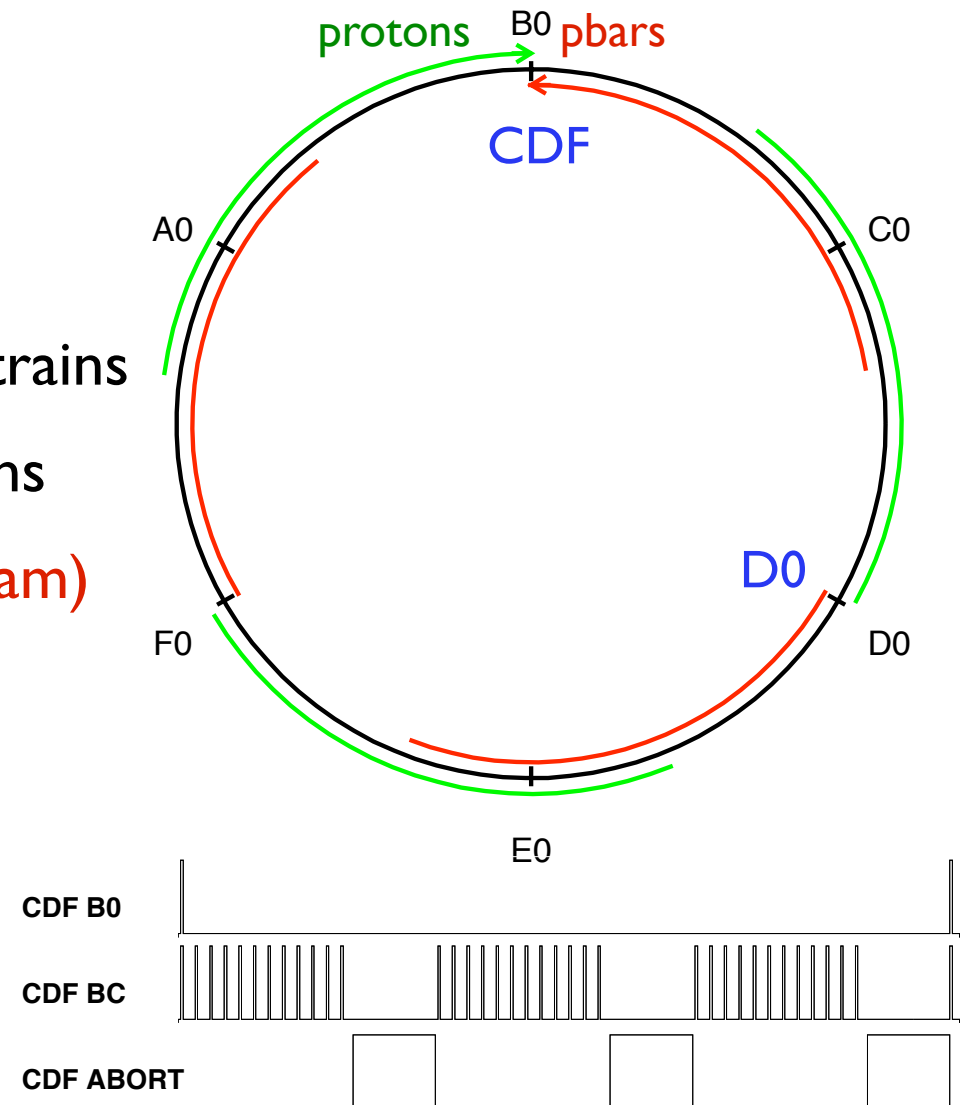
**** Devices far from CDF affect beam quality**



Beam Structure

Tevatron

- 36 Ins bunches in 3x12 bunch trains
- ~2us space between bunch trains
- * Monitor losses (in time with beam)
- * Monitor beam in abort gaps

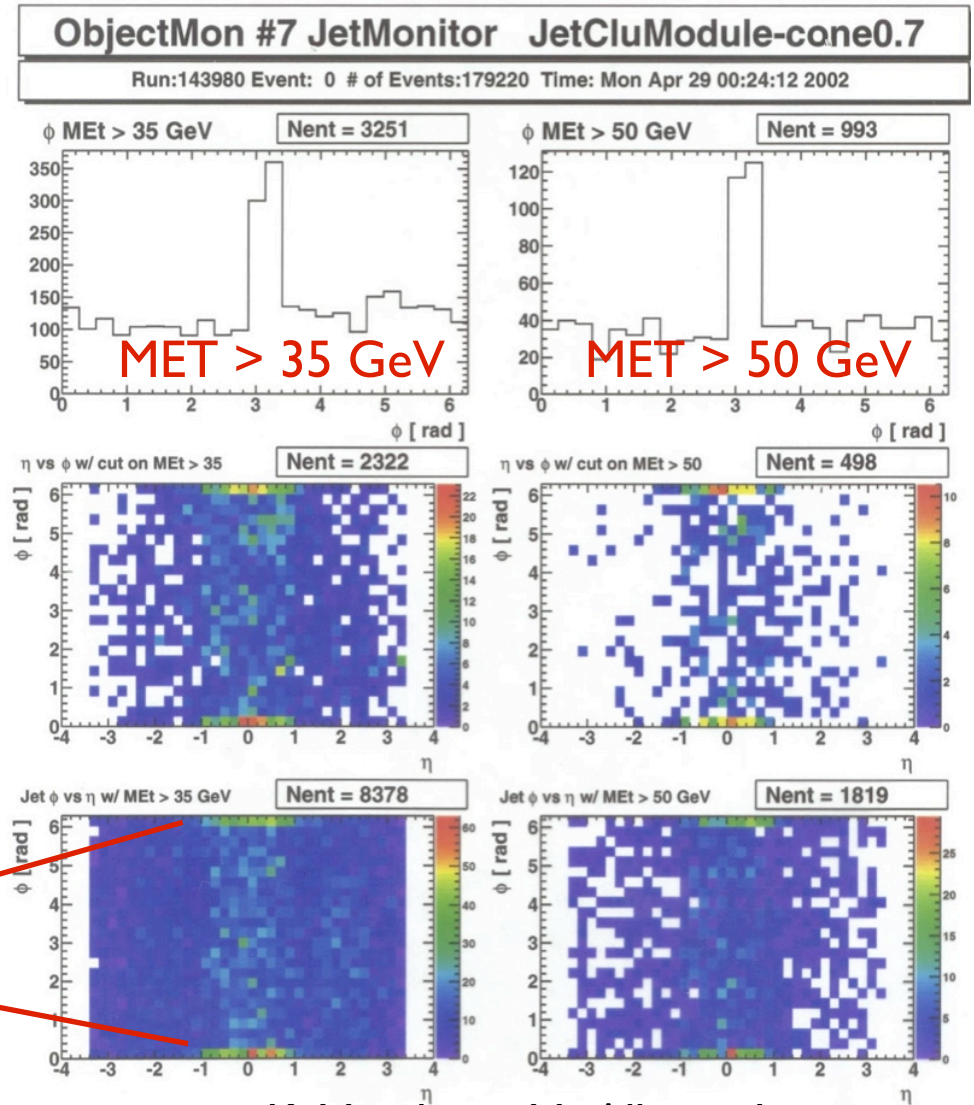


Physics Backgrounds

- Jet triggers show peak at $\phi=0$
- Missing ET triggers show peak at $\phi=\pi$
- Very energetic events
-

* Cause: diffuse beam halo interacting with roman pots ($z=-60\text{m}$)

Hot spots

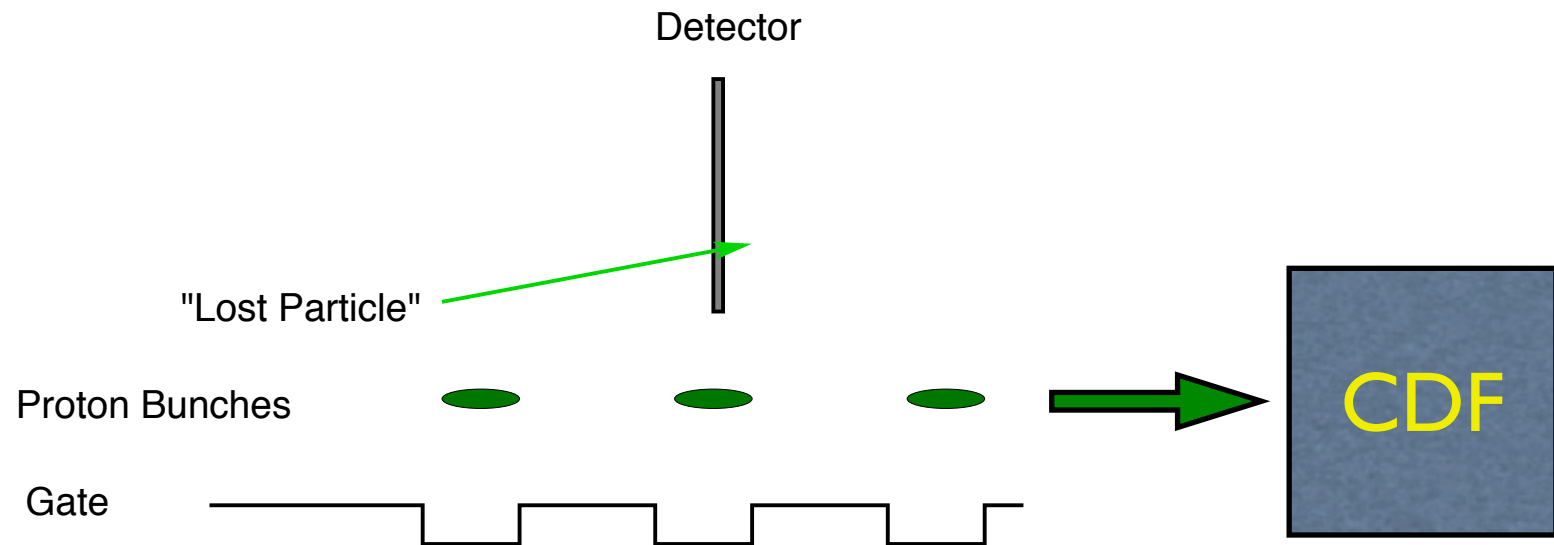


K. Maeshima, M. Albrow, J.
Spalding, K. Terashi

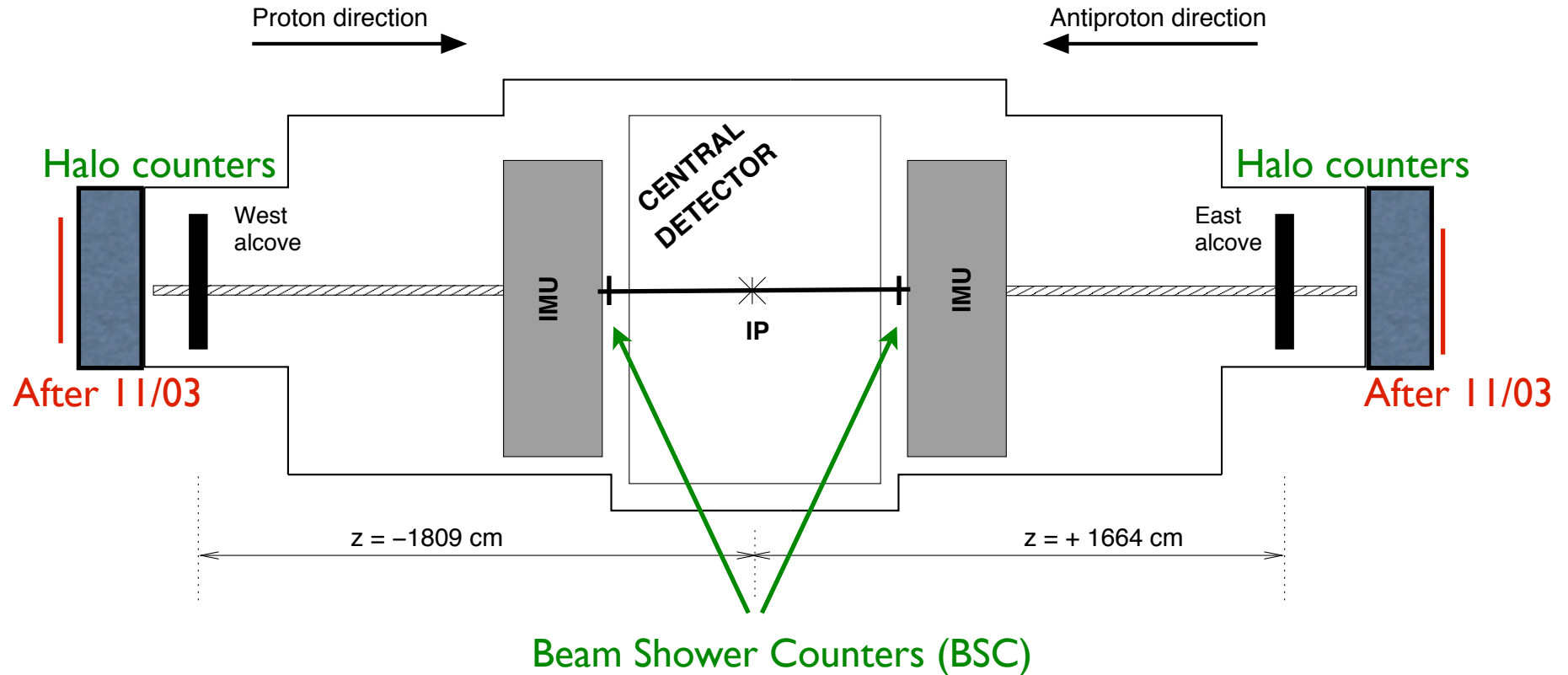
Calculating Losses

Beam Losses all calculated in the same fashion

- Detector signal in coincidence with beam passing the detector plane.
- ACNET variables differ by detector/gating method.



Beam Monitors

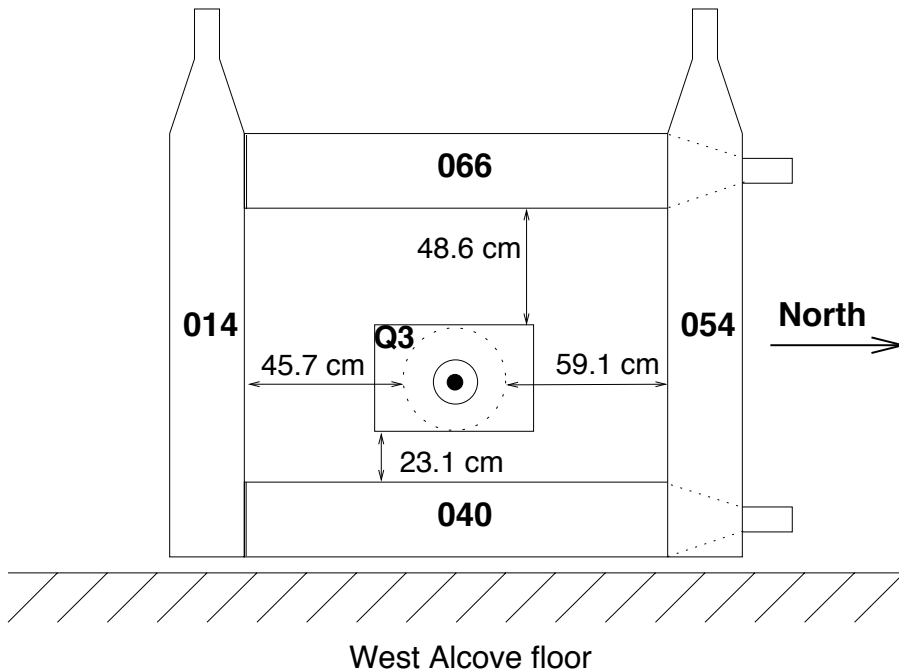


BSC counters: monitor beam losses and abort gap

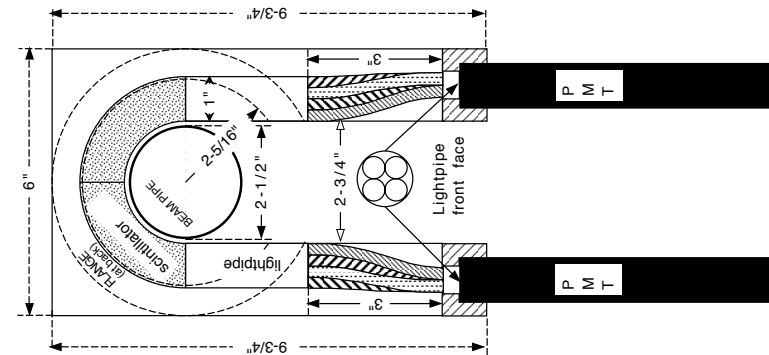
Halo counters: monitor beam halo and abort gap

Detectors

Halo Counters



Beam Shower Counters



ACNET variables:

BOPHSM: beam halo

B0PBSM: abort gap losses

B0PAGC: 2/4 coincidence abort gap losses

B0PLOS: proton losses (digital)

LOSTP: proton losses (analog)

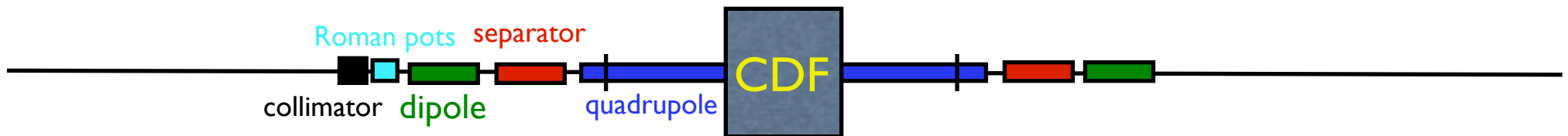
B0MSC3: abort gap losses (E^*W coincidence)

Beam Halo Counters



Protons

Antiprotons

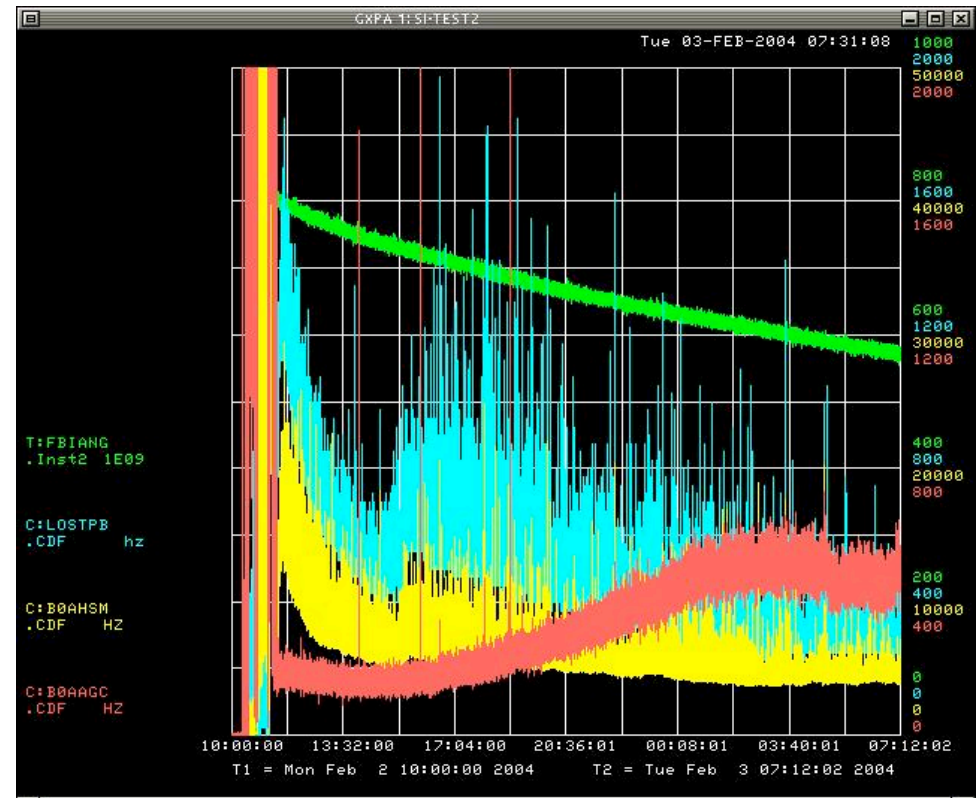
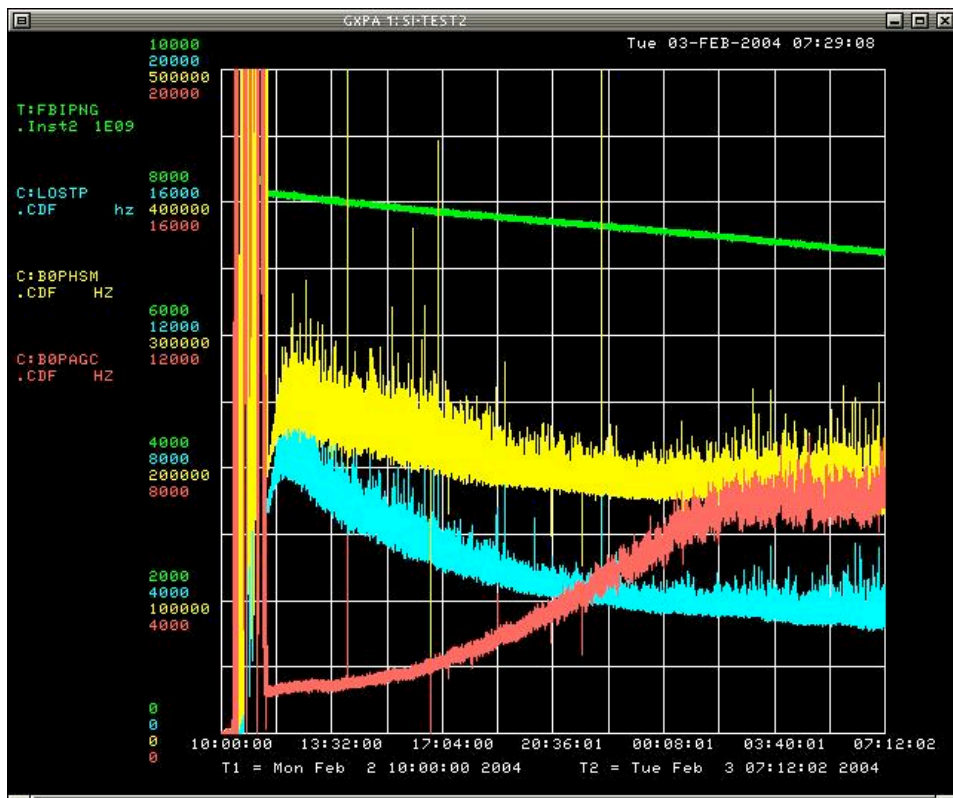


Good Store

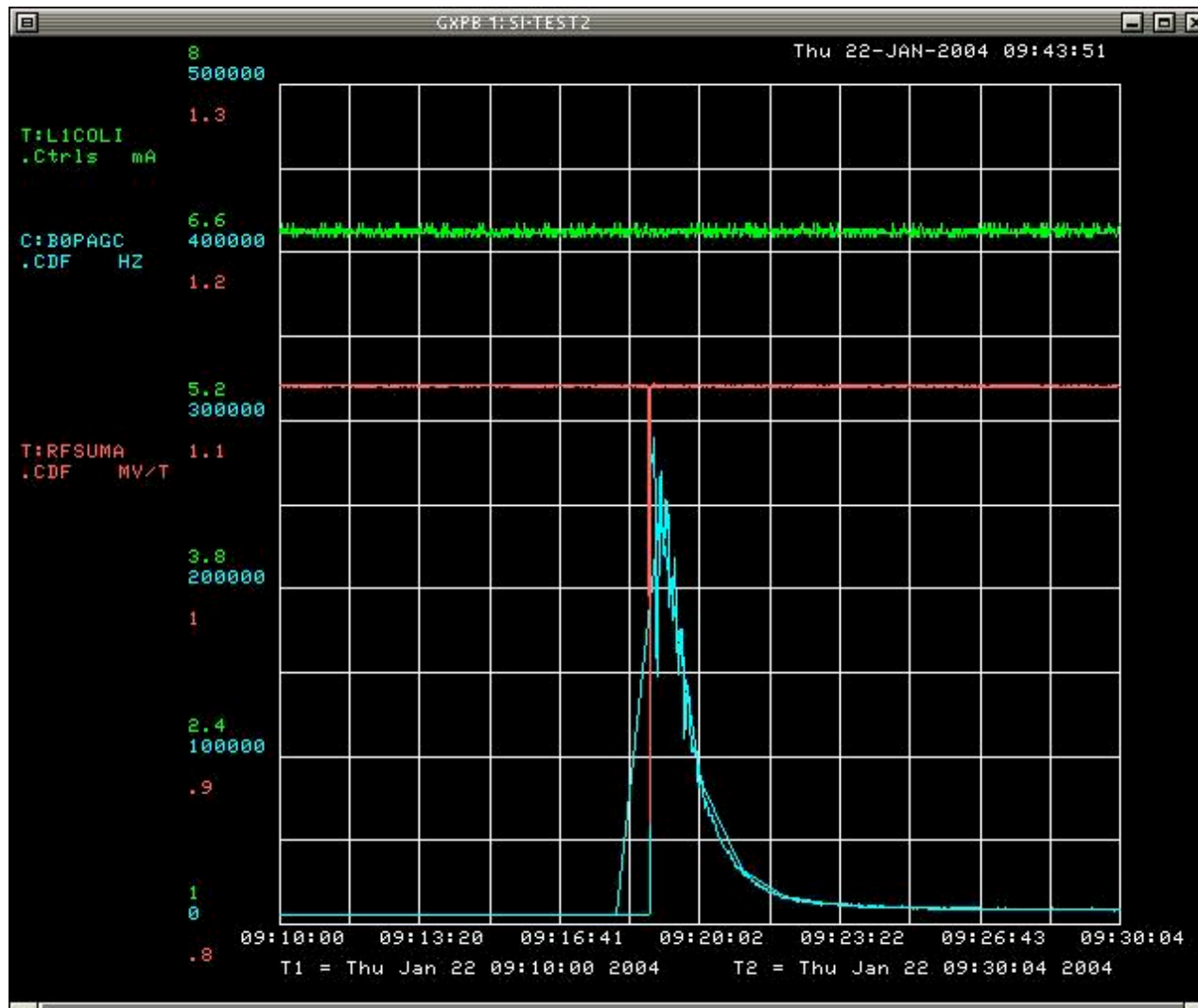
- beam current
- losses
- halo
- abort gap losses

Protons

Anitprotons



RF Problem



T:L1COLI

T:RFSUMA

C:B0PAGC

Documentation

Proton/Antiproton Losses:

Proton and antiproton Losses are measured using the beam shower counters (BSC) located closest to the B0 interaction point. The BSC-1 station consists of 4 counters arranged in quadrants around the beam pipe at approximately $z = \pm 5$ m. The active area of each counter ranges between $r = 4.4$ cm and $r = 7.0$ cm where the radius, r , is measured from the axis of the beam pipe. Losses are measured by counting the coincidences between individual counters and the proton/pbar bunch as it passes the plane of the counters on the way to the CDF interaction point.

Note: B0PLOS(B0ALOS) are calculated by summing the latched state of the counter logic signals for every bunch in a dual port memory. Consequently, the livetime of these variables is $\sim 1.5\%$. The LOSTP(LOSTPB) variables use copies of the raw counter-clock coincidences but read out the results from a rate meter; livetime of these variables is $\sim 100\%$.

Proton Losses

Device	Quantity	Description	Data Logger	Logging Rate
C:B0PLOS	Proton losses	Summed bunch by bunch losses converted to a rate (gated by CDF_BC). 1.5% live time.	CDF	1Hz
C:B0PLOS[i]	"	Proton losses by bunch (gated by CDF_BC). i=1 1st bunch after B0 marker i=2 2nd bunch after B0 marker i=36 36th bunch after B0 marker	CDF	1Hz
C:B0ALOS[i]	"	Proton losses in abort gaps (gated by CDF_ABORT). i=34 1st abort gap after B0 marker i=35 2nd abort gap after B0 marker i=36 3rd abort gap after B0 marker	CDF	1Hz
C:LOSTP	"	Rate meter version of C:B0PLOS. Saturates with high losses. Half second pulse shaping (rise time).	CDF	1Hz
C:LOSTPH	"	Copy of LOSTP with a prescale of 10. Fewer problems with saturation.	CDF	1Hz

http://www-cdfonline.fnal.gov/acnet/ACNET_beamquality.html

References

Beam and Halo Monitoring:

M. Karagoz-Unel, R.J. Tesarek, NIM [A506](#) (2003) 7-19.

M. Gallinaro, FERMILAB-CONF-02-121-E(2002) 11.

http://www-cdfonline.fnal.gov/acnet/ACNET_beamquality.html

Beam Induced Backgrounds and Radiation:

http://ncdf67.fnal.gov/~tesarek/halo/joint_physics/020503

CDF note: 5873

CDF note: 5926

CDF note: 5960

CDF note: 6753

CDF note: 6761